

Translation

INTERNATIONAL COOPERATION TREATY

PCT/EP2003/008220



PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference Az.3424	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/EP2003/008220	International filing date (day/month/year) 25 July 2003 (25.07.2003)	Priority date (day/month/year) 12 August 2002 (12.08.2002)
International Patent Classification (IPC) or national classification and IPC H01L 21/00		
Applicant MATTSON THERMAL PRODUCTS GMBH		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 10 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 9 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 05 March 2004 (05.03.2004)	Date of completion of this report 29 November 2004 (29.11.2004)
Name and mailing address of the IPEA/EP	Authorized officer
Facsimile No.	Telephone No.

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International Application No.

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I. Basis of the report

1. With regard to the elements of the international application:*

- ☐ the international application as originally filed
- ☒ the description:
pages _____ 1-29 _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☒ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement under Article 19
pages _____, filed with the demand
pages _____ 1-50 _____, filed with the letter of _____ 28 October 2004 (28.10.2004)
- ☒ the drawings:
pages _____ 1/5-5/5 _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rule 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: III.

**Non-establishment of opinion with regard to novelty,
inventive step and industrial applicability**

1. Claim 19 is vague and unclear and its scope goes beyond the scope justified by the description and illustrations (PCT Article 6).

1.1. Materials A and B and process gas components X and Y are not more precisely defined in claim 19. In view of the numerous possible combinations of A, B, X and Y that could thus be contained in claim 19, the subject matter for which protection is sought is not clearly defined and the technical problem to be solved cannot be identified.

It emerges from the description (cf. page 3, lines 4-9; page 10, lines 30-33) that that present application relates to a method for heat treating semiconductor wafers wherein a selective oxidation is carried out on a silicon layer that is to be oxidized and on a metal layer that is not to be oxidized, and wherein the formation of a volatile metallic oxide compound should be prevented. However, a method such as this cannot be found in claim 19.

Furthermore, the term "time interval" is unclear; claim 19 does not define either a lower or an upper limit for the "time interval".

1.2. Moreover, claim 19 is unclear, since the last three lines of the claim do not define any discernible

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: III.

restriction of the claimed method. Although it is stated in these lines that the concentration and/or the partial pressure of at least one component of the process gas is constantly modified as a function of the other process parameters, there is nothing in claim 19 that states that any process parameter is actually varied. In this respect, the last three lines of claim 19 do not define a change in the concentration and/or partial pressure of the process gas components *per se* - it is merely stated that if a process parameter changes, then the concentration and/or the partial pressure of one of the process gas components will be modified accordingly.

Therefore, the subject matter of claim 19, insofar as it can be understood, appears to be known from document D3 (cf. in particular D3, column 15, lines 38-46), since D3 discloses a method for heat treating semiconductor wafers, the composition of the process gas being selected such that the equilibrium reactions of the silicon oxidation are shifted toward silicon oxide and the equilibrium reactions for the tungsten oxidation are shifted toward tungsten (PCT Article 33(2)).

As far as the last three lines of claim 19 are concerned, it is also noted that fluctuations in the process parameters are unavoidable during the method known from document D3, even if they are slight. Therefore, it seems readily possible to employ the method according to D3 to achieve the constellation

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Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: III.

of processes claimed in claim 19 during a nano-interval.

Without a clarification of claim 19, it is not possible to carry out a reasonable examination of the dependent claims.

2. The following points of unclarity are also mentioned:

The statement in claim 19 that "for at least one time interval ... the first equilibrium reaction is shifted toward the first material A and the second equilibrium reaction is shifted toward the second material b" clearly contradicts the statement in claim 26 that the first and second equilibrium reactions occur in different treatment cycles (i.e. **not** during the same time interval).

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: IV.

Lack of Unity of Invention

The International Searching Authority has determined that this international application contains multiple inventions or groups of inventions that are not so linked as to form a single general inventive concept (PCT Rule 13.1), as follows:

I: Claims 1-20

Device and method for heat treating semiconductor wafers using a cover plate.

II: Claims 21-50

Method for heat treating semiconductor wafers by means of a heat treatment cycle.

The reasons are as follows:

The general idea linking independent claims 1, 13 and 19 consists in the heat treatment of semiconductor wafers with at least two different materials in a process chamber. Such an idea is already known, however (cf. D4, abstract).

The other features claimed in claim 19 relate to a treatment cycle. Neither these features nor the corresponding technical features are included in claims 1 and 13. As a result, there is no technical relationship between the two claims within the meaning of PCT Rule 13.2. Therefore, the requirement of unity of invention has not been satisfied.

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V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-18	YES
	Claims		NO
Inventive step (IS)	Claims		YES
	Claims	1-18	NO
Industrial applicability (IA)	Claims	1-18	YES
	Claims		NO

2. Citations and explanations

Reference is made to the following documents:

D1: DE 100 60 628 A

D2: US-A-5 861 609

D3: US-B1-6 197 702

D4: US-B-6 228 752

Invention I (claims 1-20)

1.1. A device 1 for heat treating semiconductor wafers with at least one silicon layer that is to be oxidized and one metal layer that is not to be oxidized is known from document D1 (cf. the illustration and associated text). The device includes the following:

at least one radiation source 6;

a treatment chamber 5 encompassing the substrate 8, with at least one wall component lying adjacent to said radiation source and being substantially transparent to the radiation from the radiation source (cf. D1, column 2, lines 52-54); and

at least one cover plate 11, 12 between the substrate 8 and the transparent wall component of the treatment chamber lying adjacent to the radiation source, said cover plate being dimensioned such that it completely covers the transparent wall component of the treatment chamber with respect to the substrate in order to prevent material that is precipitating and evaporating from the substrate from contacting the transparent wall component of the treatment chamber.

The feature of claim 1 of the present application that the material precipitating and evaporating from the substrate comprises a metal, a metallic oxide or a metallic hydroxide refers to the use of the claimed device and does not define a device feature per se.

The device according to the present claim 1 thus differs from the device known from D1 by the features disclosed in lines 19-23 of claim 1. However, this difference is not considered inventive for the following reasons:

According to document D1, the cover plates are removed from the treatment chamber for cleaning and are then reinserted (cf. D1, column 3, lines 20-25). Providing a manipulation device to automatically remove and reinsert the cover plate is obvious, since automation of semiconductor production is the norm. Additionally, contacting only the surface of the cover plate that faces away from the substrate is considered a conventional approach, since it is obvious to a person skilled in the art that otherwise the manipulation device and possibly also the

treatment chamber could become contaminated (for example, by the possible flaking of the material precipitated onto the cover plate), which could have consequences.

Therefore, the subject matter of claim 1 of the present application is not considered inventive (PCT Article 33(3)).

1.2. Moreover, the other features claimed in claims 2, 5, 6, 10 and 11 are known from document D1:

Claim 2 - cf. D1, column 3, lines 10-13

Claim 5 - cf. D1, illustration; paragraph 0016

Claim 6 - cf. D1, column 3, lines 61-64

Claim 10 - cf. D1, column 3, lines 32-35 and 61-64

Claim 12 - cf. D1, illustration; column 2, line 45.

1.3. The subject matter of claims 3 and 4 is only one of several obvious possibilities from which a person skilled in the art would choose according to the circumstances in order to insert the cover plate and the substrate into the chamber and remove them from it without thereby exercising inventive skill. It is also noted with regard to claim 3 that this type of retaining arrangement for a cover plate is already known in a similar device according to document D2 (cf. D2, illustrations, plates 20, 30 on retaining elements 52).

1.4. Providing a control unit for controlling the discharge of gasses into the chamber (cf. claim 12 of the present application) is obvious.

1.5. Coating the surface of the cover plate that faces the substrate with a material that is easy to clean is an

obvious approach to facilitating the cleaning of the plate (cf. claims 7 and 8 of the present application).

1.6. A light-absorbing plate 10, 30 is known from document D2. A person skilled in the art would consider the incorporation of such a plate into the device described in D1 to be an obvious measure (cf. claim 9 of the present application).

1.7. As is known from document D1 (cf. D1, paragraphs 0003 and 0004), the device according to D1 can be used in oxidation processes, coating material being evaporated from the semiconductor wafers. It is thus obvious to use the device according to D1 for the per se known method for heat treating semiconductor wafers with at least one semiconductor layer that is to be oxidized and one metal layer that is not to be oxidized, the precipitating or evaporating material comprising a metal, metallic oxide or metallic hydroxide (cf. D3).

Therefore, the subject matter of claim 13 of the present application is considered obvious.

1.8. The other feature claimed in claim 14 of the present application is known from document D1 (cf. D1, column 3, lines 20-25).

1.9. A method for heat treating semiconductor wafers with at least one silicon layer that is to be oxidized and one tungsten layer that is not to be oxidized is known from document D3. Said method includes the process steps described in claims 15-17 of the present application (cf. D3, column 16, lines 12-39; column 15, lines 38-52).

Furthermore, figure 12 of D3 shows that the proportion of water at a temperature of approximately 900°C (cf. D3, column 16, lines 24-26) should be selected to be less than approximately 50%; the proportion of water selected according to the subject matter of claim 20 of the present application falls within the range indicated in figure 12 of document D3. However, a selection such as this can be considered inventive only if the proportion of water has unexpected effects or properties with respect to the rest of the range. Such effects or properties are not disclosed in the application, though. For this reason, the subject matter of claim 18 does not involve an inventive step.